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FOR PROMOTING USEFUL KNOWLEDGE

THE ORIGIN AND DISTRIBUTION OF THE GENERA OF THE FISHES OF SOUTH AMERICA WEST OF THE MARACAIBO, ORINOCO, AMAZON, AND TITICACA BASINS.[1]

By CARL H. EIGENMANN.

(*Read March 4, 1921.*)

The territory defined in the title includes Panama, Colombia, west of the Cordillera de Bogota, and the Pacific slope of Ecuador and Peru.

The area is bounded on the south by the desert of Atacama, on the west by the Pacific Ocean, on the north by the Isthmus of Panama and the Caribbean Sea, on the east by high mountains, the Sierra Nevada de Santa Marta, the Cordillera de Perija, and the Cordillera of Bogota in Colombia, in small part by the Cordillera Oriental in Ecuador, and by the Cordillera Occidental in the rest of Ecuador and the whole of Peru.

The largest river basin in this area is that of the Magdalena. The Magdalena, Sinu, Atrato, and Chagres drain into the Atlantic; the Chepo, Tuyra, San Juan, Dagua, Patia, Mira, Esmeraldas, Guayas, and many short turbulent rivers south of it drain into the Pacific. The coastal portion north of central Ecuador is very wet, with a heavy annual rainfall; the lower portion south of Guayaquil is without rain. The rivers are supplied with water from the mountains only.

In a faunal volume recently finished, 388 species of fresh-water fishes are recognized from this area. They are referred to 108

[1] Contribution from the Zoölogical Laboratory of Indiana University, No. 180.

strictly fresh-water genera.[2] What is the origin of this fauna? The solution to this problem is given by the distribution and relationship of the 108 genera. We find:

1. Sixty-five of the genera are also found east of the Andes where they are for the most part widely distributed. They are marked with the — in the second column of the table below. The ancestors of the species of these 65 genera (66 if we include Rivulus, which is in part marine) had a common origin with the species found in the Atlantic slope rivers. They constitute about 60 per cent. of the total.

2. Twenty-eight of the genera are modifications of some of the above 65 or of other genera widely distributed east of the Andes. The derivation is in many cases quite evident and direct. For instance:

Xiliphius is a modified *Bunocephalus; Cetopsorhamdia* and *Nannorhamdia* are modified *Rhamdia; Eremophilus* is a modified *Pygidium; Cheiridodus* is a modified *Plecostomus; Lebiasina* is a modified *Piabucina* and a per cent. of individuals of *Lebiasina* still revert to *Piabucina; Compsura* and *Pseudocheirodon* are modified *Cheirodon; Orthonophanes* is a modified *Brycon; Argopleura, Microgenes,* and *Phenacobrycon* are modifications of *Bryconamericus; Landonia* is a modified *Astyanax; Acestrorhynchus* is a modified *Acestrocephalus; Ctenolucinus* is a modified *Xiphostoma;* and so on. In a number of other cases the immediate origin is not so evident: *Parastremma* and *Rhoadsia* form a distinct subfamily. Their young are in all technical respects members of the Cheirodontinae, from which they no doubt evolved. *Gilbertolus* is allied to the *Characinæ; Genycharax* to *Astyanax* or *Charax; Grundulus* and *Phanagoniates* are of the *Cheirodontinæ, Pterobrycon* and *Microbrycon* of the *Glandulicaudinæ.* All are marked A in the first column. They constitute nearly 26 per cent. of the total.

Ten of the genera have either come from Central America or

[2] Exclusive of the marine or brackish water genera, *Pristis, Hexanematichthys, Sardinella, Stolephorus, Anchovia, Tylosurus, Mugil, Querimana, Agonostomus, Joturus, Centropomus, Pomadasys, Tarpon, Dormitator, Eleotris, Philypnus, Guavina, Gobius, Gobionellus, Awaous, Gobioides, Thalassophryne, Batrachoides, Citharichthys, Achirus.*

are modifications of immigrants from Central America, marked x. They constitute 9.2 per cent. of the total.

Five of the genera are modifications of immigrants from the ocean, marked O. They constitute 4.6 per cent of the total.

There is no genus in the entire area whose derivation is in doubt. The fauna is largely a part of the general South American fauna which has been pinched off by the formation of the Andes and has gone its own way since the Andes have become high enough to form an effective barrier against the ready intermigration between the cisandean and transandean parts of the continent.

The relation of the faunas of the different rivers in the area to each other is receiving consideration in separate papers.[3]

TABLE OF THE DISTRIBUTION OF GENERA.

In the column "Origin"

A = Genera which are evidently modifications of present-day Orinoco or Amazon genera.

C = Genera of the Pacific slope some of which are also in the Chagres, others in the Atrato.

X = Genera of Northern, Central American origin.

O = Genera of brackish water origin.

* = Pacific slope genera found only in the Atrato or Chagres of the Atlantic slope drainage.

The dash (—) indicates that the genus occurs in the particular river. The addition mark (+) indicates that within the area the genus is limited to the one river.

Columns 4 to 7 in sequence give a line of migration, 11, 12, 13, 14, 15 give a different line, 11 being a duplicate of 4; columns 8, 9, 10 represent a fauna distinct from that in the Magdalena-Atrato-San Juan system shown in columns 3 to 7. The second column indicates the Maracaibo, Orinoco, or Amazon basins.

[3] I regret to say, that so far, I have not been able to give consideration to the Santa river nor to the lower courses of the Rio Loa and to those of southern Peru. I hope that I may be able to visit these rivers in the near future.

	1. Origin.	2. Cis Andes.	3. Magdalena Basin.	4. Atrato Basin.	5. San Juan Basin.	6. Dagua Basin.	7. Patia Basin.	8. Guayaquil Basin.	9. Paita.	10. Pacasmayo.	11. Atrato Basin.	12. Tuyra Basin.	13. Chepo Basin.	14. Pacific Slope of Canal Zone.	15. Chagres Basin.
POTAMOTRYGONIDÆ															
1. *Potamotrygon*		—	—	—							—				
ASPREDINIDÆ															
2. *Bunocephalus*		—	?	—	?	?	—				—				
3. *Xiliphius*	A		+												
SILURIDÆ															
4. *Pseudopimelodus*		—	—	—	—	?	—				—				
5. *Microglanis*		—						+							
6. *Perugia*		—	+												
7. *Cetopsorhamdia*	A		+												
8. *Rhamdia*		—	—	—	—	—	—	—			—	—	—	—	—
9. *Nannorhamdia*	A		—	—	—		—				—				
10. *Pimelodella*		—	—	—	—	—	—	—	—	—	—	—	—	—	—
11. *Pseudoplatystoma*		—	+												
12. *Sorubim*		—	+												
13. *Doras*		—	+												
14. *Trachycorystes*		—	—	—							—	—			
15. *Ageneiosus*		—	—	—							—				
16. *Astroblepus*		—	—	?	—	—	—	—		—	?	—			
CETOPSIDÆ															
17. *Paracetopsis*	AC							+							
18. *Hemicetopsis*		—	?	—	—	?	—				—				
PYGIDIIDÆ															
19. *Pygidium*		—	—	?	—	—	—	—	—	—	?				
20. *Eremophilus*	A		+												
CALLICHTHYIDÆ															
21. *Corydoras*		—	+												
LORICARIIDÆ															
22. *Plecostomus*		—	—	?				—			?	—	?	—	—
23. *Hemiancistrus*		—	?	—	—	?	—	—			—				
24. *Pterygoplichthys*		—	+												
25. *Lasiancistrus*		—	—	?	—						?	—			
26. *Pseudancistrus*		—	—	?	—	—					?				
27. *Leptancistrus*	AC											+			
28. *Panaque*		—	+												
29. *Cheiridodus*	A		—	?	—						?				
30. *Chaetostomus*		—	—	—	—		—	—			—	—	—		—
31. *Ancistrus*		—	?	—	—			-?			—	—	—	—	—
32. *Loricaria*		—	—	—	—	?	—				—	—	—	—	—
33. *Sturisoma*		—	—	—	—	—					—	—	—		
34. *Farlowella*		—	+												
CHARACIDÆ															
35. *Curimatus*		—	—	—	—	—	—	—	—		—	—	—	—	
36. *Parodon*		—	—	—							—				
37. *Apareiodon*		—						—				—			
38. *Saccodon*	AC							+							

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39. *Prochilodus*		–	–	–				–			–				
40. *Characidium*		–	–	–											
41. *Pyrrhulina*		–	+												
42. *Lebiasina*	AC			–	–	?	?	–	–	–	–				
43. *Piabucina*		–	?	–	–	?	–	–			–	–	–	–	–
44. *Grundulus*	A		+												
45. *Phanagoniates*	AC*			–							–	–			
46. *Compsura*	A											–	–	–	–
47. *Odontostilbe*		–	–	–							–				
48. *Pseudocheirodon*	A											–	–	–	–
49. *Cheirodon*		–	–	–							–				
50. *Brycon*		–	–	–	–	–	–	–	–	–	–	–	–	–	–
51. *Othonophanes*	A		+												
52. *Pseudochalceus*	AC							+							
53. *Hyphessobrycon*		–	–	–	–	–	–	–			–				–
54. *Astyanax*		–	–	–	–		–	–			–	–	–	–	–
55. *Genycharax*	A		+												
56. *Creagrutus*		–	–	–	–			–			–	–			–
57. *Argopleura*	A			–	–	–					–				
58. *Phenacobrycon*	AC							+							
59. *Microgenys*	A		+												
60. *Bryconamericus*		–	–	–	–	–	–	–	–	–	–	–	–	–	–
61. *Landonia*	AC							+							
62. *Hemibrycon*		–	–	?			–	–			?	–			
63. *Nematobrycon*	AC*			–	–			–			–				
64. *Parastremma*	AC*			–	–	?	–				–				
65. *Rhoadsia*	AC							+							
66. *Pterobrycon*	A			+							+				
67. *Microbrycon*	A			+							+				
68. *Gephyrocharax*		–	–	–	–						–	–	–	–	–
69. *Chalcinus*		–	+												
70. *Thoracocharax*		–	–	–	–						–	–	–	–	
71. *Charax*		–	–	–							–				
72. *Roeboides*		–	–	–	–	?	–				–	–	–	–	–
73. *Acestrocephalus*	A		+												
74. *Gilbertolus*	A			–	–						–				
75. *Ctenolucinus*	A			–	–						–	–	–	–	
76. *Hoplias*		–	–	–	–	?	–	–			–	–	–	–	–
GYMNOTIDÆ															
77. *Gymnotus*		–	?	–	–						–				
78. *Sternopygus*		–	–	–	–	–	–	–			–	–			
79. *Eigenmannia*		–	–	–							–	–	–		
80. *Hypopomus*		–	–	–	–						–	–	–		–
81. *Sternarchus*		–	–	?	–						?	–			
SYNBRANCHIDÆ															
82. *Synbranchus*		–	–	?	–						?				

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ANGUILLIDÆ															
83. *Anguilla*	×		+												
POECILIIDÆ															
84. *Gambusia*	×		—					–?					—	—	—
85. *Priapichthys*	×			—	—						—	—	—	—	—
86. *Mollienisia*	×		—	?							?	—	?	—	—
87. *Rivulus*	×		—	—	—						—				—
88. *Pseudopœcilia*	×							+							
89. *Diphyacanthus*	×				+										
90. *Neoheterandria*	×			+							+				
ATHERINIDÆ															
91. *Thyrina*	o					—	—	—							
92. *Menidia*	o														+
SCIÆNIDÆ															
93. *Plagioscion*		—	—												
CICHLIDÆ															
94. *Geophagus*		—	—	—	—						—	—	—	—	—
95. *Aequidens*		—	—	—	—	?	—	—	—	—	—	—	—	—	—
96. *Nectroplus*	×														—
97. *Cichlasoma*		—	—	—	—	—	—	—			—	—	—		—
GOBIIDÆ															
98. *Hemieleotris*	o				—	—							—	—	
99. *Leptophylipnus*	o														+
100. *Microeleotris*	o													—	—
101. *Sicydium*		—	—		—	—								—	—
102. *Pimelodus**		—	—	—							—	—			
103. *Hoplosternum*		—	—	?							?	?	?	—	
104. *Leporinodus*		—	+												
105. *Abramites*		—	+												
106. *Leporinus*		—	—	—				—				—			
107. *Salminus*		—	+												
108. *Pœciliopsis*	×					—									—
Totals		65	74	52	45	17	26	33	7	7	52	37	26	26	31
Number of genera not in the Magdalena				8	10	1	4	12				8	6	6	10
Per cent of the genera not in the Magdalena				15	22	6	15	36				21+	32	27	32
Per cent of its genera peculiar to the river			33.8†	6	2.2	0	0	24				2.7	0	0	6+

* Numbers 102 to 108 are out of their regular places. 102 should go after 9, 103 should go after 21, 104–106 should go after 40, 107 should go after 72, and 108 should go after 90.

† This includes many genera widely distributed in the region east of the Cordillera of Bogota which west of them are found only in the Magdalena.